UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.14 (3);
https://unijerps.org
2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355.
July-December, 2022
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363

TEACHING EXPERIENCE AS PREDICTOR OF PEDAGOGICAL CONTENT KNOWLEDGE OF BIOLOGY TEACHERS IN ENUGU STATE

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ABSTRACT
The study investigated the strength of teaching experience for predicting the pedagogical content knowledge of biology teachers in Enugu Education Zone. Three research questions guided the study and three null hypotheses were tested at 0.05 level of significance. The study adopted a correctional research design. The population of the study comprised of eighty four (84) biology teachers in the thirty (30) public secondary schools that make the education zone. The instrument used for data collection was a structured questionnaire titled "Biology Teachers Knowledge of Subject Matter, Instructional Strategies and Curriculum" (BTKSMISC). The instrument was validated by two experts in the Department of Science Education, Nnamdi Azikiwe University, Awka. Using Cronbach Alpha, the overall Mean coefficient of internal consistency was found to be 0.80 for section B (Q1 - 0.90, Q2-0.070, Q3-0.80). Simple regression analysis was used to answer the research questions and to test the null hypotheses at 0.05 levels of significance. The result revealed that teaching experience contributed significantly in the prediction of biology teachers' subject matter knowledge. It also revealed that teaching experience was not significant predictor of biology teacher's knowledge of instructional strategy and did not make a significant contribution in explaining biology teachers' knowledge of biology curriculum in Enugu Education Zone. Based on the findings, the researchers recommended among other, that teaching experience should not only be considered in the selection of teachers for the mentoring of novice biology teachers.

Keywords: Teaching Experience, Pedagogical Content Knowledge, Biology Students.

Introduction

Learning is the process of acquiring new or modifying existing knowledge, behaviours, skills, value or preference (Obialor & Osuafor, 2019). Learning is composed of three main factors; the knowledge, the learner and the teacher (Ezennwabachili, 2016). There have been debates in recent times as to which takes pre-eminence among the three factors of learning. Recent trends in education have enthroned the learner over the other factors of learning. This trend is opposed to the classical trend that positioned the teacher at the very centre of the learning process (McCombs in Ezennwabachili, 2016). Whatever the trend of the argument is, the place and role of the teacher cannot be relegated to the background because of its central position in the learning process. This

becomes more relevant when one considers practical science subjects like biology.

Biology is one of the science subjects students learn in the senior secondary schools. The National Curriculum for Senior Secondary School Biology (2008) specifically stated that the objectives for the study of biology are to prepare students to acquire: a) Adequate laboratory skills in biology b) meaningful and relevant knowledge in biology c) ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture d) reasonable and functional scientific attitudes. Biology is also very vast and multi-faceted since it consists of varied concepts, facts and theories which the students are expected to internalize. It is therefore, imperative that a biology teacher should employ diverse strategies to enable students acquire the content knowledge, the laboratory skills and appropriate scientific attitudes needed in problem solving. However, for students of biology to acquire the relevant practical skills and develop the right scientific attitude, there is the ardent need for a proper guidance and assistance from the teacher. The teacher must have a sound pedagogical content knowledge of biology.

Pedagogical content knowledge (PCK) is the knowledge of how to transform formal subject matter knowledge into meaningful learning outcomes for students. Pedagogical content knowledge is an academic construct that represents an intriguing idea. This idea is rooted in the belief that teaching requires good knowledge of subject matter, curriculum and teaching methods considerably more than delivering subject content knowledge to students and that students' learning is considering more than absorbing information for later accurate regurgitation. Pedagogical content knowledge also involves teacher understanding of a particular topic and how to explain the topic or concepts so as to make sense to the students in the classroom (Adedoyin, 2011). This means that teachers are always expected to exhibit a basic set of pedagogical knowledge and skills in the classroom for effective teaching-learning process to occur in our educational system. However, to determine the teacher pedagogical content knowledge, the teacher teaching experience must be considered.

Teaching experience has to do with the number of years a teacher has spent in teaching a subject. Teaching experience is associated with the teachers' pedagogical content knowledge in teaching his/her subject (Mthethwa-Kunene, 2014; Sarpong & Apaak, 2016). Berliner (2004) stressed that time and experience play a similar role in the development of pedagogical expertise. Kosgoi, Mise,Odera and Ayugi in Ezennwabachili (2016) opined that experienced teachers have richer background of experience to draw from and can contribute insight and ideas to the course of teaching and learning. Apata in Bello (2015) asserted that experience serves to nourish teachers through exposure to training, rearing and upbringing and socializing them into teaching the culture that translates into good pedagogical technique and problem-solving strategies required of students. Anastasia (2015) observed that teachers with long experience use better classroom management approaches and adequate teaching methods

that encourage students' autonomy and reduce teacher control, thus taking responsibility for students learning needs, managing classroom problems and keeping students on tasks. Experience teachers are open to corrections and are less dictatorial in the classroom. Furthermore, experienced teachers are considered to be more able to concentrate on the most appropriate way to teach particular topics to students who differ in their abilities, prior knowledge and backgrounds. In addition, the more the teachers know about their students, the better the teachers can connect with them and the more the students' will be able to benefit from the teachers' experience in reconstructing their world. This implies that the more experienced a teacher is, the more efficient and effective he/she becomes in teaching and the more the students understand the lessons and possibly perform better in the examination. However, it appears that students' learning outcome or performance in biology has not been encouraging over the years. For instance, John and Kawu (2015) reported that students who passed biology at credit level (C6-A1) from 2012-2014 in Nigeria were 38.8%, 36.57% and 31.28% respectively. Similary Okeke in Obialor (2022) stated that NECO statistical analysis of the 2015 June/July result revealed that biology was one of the subjects that had high failure rate of 31,885 candidates (4.43%) among other science subjects. Again, it was reported by the WAEC Chief Examiner of biology in 2019 that the performance of candidates in biology fell below expectation. The report classified candidates weakness under the following sub-headings i) poor spellings of some technical terms, poor performance in questions that require application of knowledge, inability to answer questions that require corresponding answers correctly, inability to relate and state observable structures of organism and their functions, not giving titles to drawings among others. Literature available to the researchers shows no evidence that there has been such a study that examined the predictive power of teaching experience over biology teacher pedagogical content knowledge (PCK) in biology particularly in Enugu State. For example, Bello (2015) carried out a study on effect of teacher teaching experience and qualification on their conduct of effective biology practical lesson in Sokoto State while Abimbola & Abidoye, (2013) examined the effect of qualification and experience of biology teachers on the status of ecology teaching. Hence, the present study seeks to address this gap by determining how well teaching experience predicts pedagogical content knowledge of secondary school biology teachers in Enugu Education Zone.

Research questions

The following research questions guided the study

1. To what extent does teaching experience predicts subjects matter knowledge of biology teachers in secondary schools in Enugu Education Zone?
2. To what degree does teaching experience predicts biology teachers' knowledge of instructional strategies in secondary schools in Enugu Education Zone?

3. To what extent does teaching experience predicts biology teachers' biology curriculum knowledge in secondary schools in Enugu Education Zone?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance

1. Teaching experience is not a significant predictor of subject matter knowledge of biology teachers in secondary schools in Enugu Education Zone.
2. Teaching experience is not a significant predictor of biology teachers' knowledge of instructional strategies n secondary schools in Enugu Education Zone.
3. Teaching experience is not a significant predictor of biology teachers' biology curriculum knowledge in secondary schools in Enugu Education Zone.

Research Method

The design for the study was a correlation survey. According to Nworgu (2015) correlation studies seek to establish what relationship that exists between two or more variables. This study was conducted in Enugu Education Zone, Nigeria. The population of this study comprised of eighty four (84) biology teachers in public secondary schools in Enugu Education Zone. The entire population of the study was used as the sample size for the study. This is as a result of the smallness of the number that constituted the population of the study. The instrument used for data collection was structured questionnaire titled Biology Teachers Knowledge of Subject Matter, Instructional Strategies and Curriculum (BTKSMISC). The questionnaire instrument has two sections A and B. Section A consisted of bio-data of the respondents such as sex and years of teaching experience. Section B consisted of items on biology teachers' knowledge of the subject matter, their knowledge of instructional strategies and their knowledge of curriculum as related to Pedagogical Content Knowledge of biology teachers in Enugu Education Zone. The instrument also consisted of questions with peculiar response patterns. The first question for example comprised thirty objectives test questions on biology (15 each from ecology and genetics). The second question comprised of questions on the adequacy of teaching methods for particular aspects of ecology and genetics. The adequacy of these methods was sifted from the Biology Curriculum following the stipulated activities for teachers and students outlined in the curriculum. The response pattern was Very Adequate (VA), Adequate (A), Slightly Adequate (SA), and Not Adequate (NA). The third question was on the knowledge of the curriculum. The questions were developed from the biology curriculum with the response pattern; SA- Strongly Agree, A- Agree, D- Disagree and SD- Strongly Disagree. The questionnaire as designed by the researchers comprised of 48 items. The instrument was validated by two experts in Department of Science Education Nnamdi Azikiwe University Awka. To determine the reliability of the instrument BTKSMISC, twenty (20) copies of the

questionnaire were administered to biology teachers in private secondary schools in Enugu Education Zone. The internal consistency of the questionnaire was determined using Cronbach Alpha. The overall mean coefficient of internal consistency of 0.80 was obtained for section B (Q1- 0.90, Q2- -0.70, Q3-0.80). The instrument was administered to the respondents by the researchers with the help of three research assistants; one from each three local government area that made up the education zone. On the spot method of data collection was used as to enhance high returns of the instrument administered to the respondents. Simple Regression analysis was used to answer the research question and test the null hypotheses at 0.05 level of significance. The regression was used because it enables one to judge the strength of the predictor in predicting the outcome variable as well as goodness of the fit of the regression model using the regression coefficient (R), the R^2 and the R^2. It also enables one to know whether the predictor makes significant contribution or not using the F-statistic, t-value and the associated probability value (*P*). The decision rule on the degree/extent to which each of the predictors predicts the outcomes was based on Muiji in Cohen, Manion and Morriso (2007) guidelines for evaluating how fit or good a regression model is using adjusted R square as indicated below:

Adjusted R^2 :
< 0.1 = poor
0.11-0.3 = modest
0.31-0.5= moderate
> 0.5= strong

Presentation of Result

The result were presented in line with the research questions and hypotheses that guided the study

To what extent does teaching experience predicts subjects matter knowledge of biology teachers in secondary schools in Enugu Education Zone?

Research Question One

Table1: Summary of simple regression analysis with teaching experience as predictor of subject matter knowledge of biology teachers

	B	*SE B*	B
Constant	61.977	1.377	
Knowledge of subject matter	12.399	2.010	.568
R .568			
R^2 .323			
Adj.R^2 .314			
F 37.693			

Data in table 1 shows that the simple regression coefficient (R) is .568 while the coefficient of determination (R^2) is .323. This is an indication that teaching experience explained 32.3% of the variance in subject matter knowledge of biology teachers. Using Muijs' criteria for judging goodness of fit/model, the adjusted R^2 of .314 which fall between 0.31-0.05 shows that teaching experience predicts subject knowledge to a moderate extent.

Research Question Two

To what degree does teaching experience predicts biology teachers' knowledge of instructional strategies in secondary schools in Enugu Education Zone?

Table2: Summary of simple regression analysis with teaching experience as predictor of biology teachers' knowledge of instructional strategies

	B	*SE B*	B
Constant	5.125	1.380	
Knowledge of instructional strategies	-.59	.051	-.129
R	.129		
R^2	.017		
Adj.R^2	.004		
F	1.336		

Data in table 2 shows that the simple regression coefficient (R) is .129 while the coefficient of determination (R^2) is .017. This is an indication that teaching experience explained 1.7% of the variance in knowledge of instructional strategies of biology teachers. Considering the size of the Adjusted R^2 was less than 0.11, teaching experience, it was decided that it poorly predicts teachers' knowledge of instructional strategies.

Research Question Two

To what extent does teaching experience predicts biology teachers' biology curriculum knowledge in secondary schools in Enugu Education Zone?

Table3: Summary of simple regression analysis with teaching experience as predictor of biology teachers' biology curriculum knowledge

	B	*SE B*	B
Constant	4.232	1.260	
Knowledge of biology curriculum	-.052	.095	-.062
R	.062		
R^2	.004		
Adj.R^2	-.009		
F	.305		

As shown by the summary of simple regression analysis in table 3, the regression coefficient (R) =.062, the coefficient of determination (R^2) =.004 while F-ratio =.305. The unstandardized (*B*) and the standardized regression beta weights (B) were -052 and -.062 respectively. Considering the size of the Adjusted R^2 which was less than 0.11, it was decided that teaching experience poorly predicts teachers' biology curriculum knowledge

Hypotheses

Hypotheses One

Teaching experience is not a significant predictor of subject matter knowledge of biology teachers in secondary schools in Enugu Education Zone.

Table 4: Test of significance of simple regression analysis with teaching experience as predictor of subject matter knowledge of biology teachers'

	B	SE B	*β*	t	*p*-value
Constant	-2.460	.901		-2.730	0.08
Knowledge of subject matter	.089	.013	.605	6.747	0.00
R .605					
R^2 .366					
Adj.R^2 .356					
F 45.526					0.00

As shown in table 4 above, the simple regression coefficient(R) is .605 while the R^2 is .366. the F-ratio associated with these is 45.52 and the P-valve =.000, since P-value is less than the stipulated 0.05 level of significance, it was decided that teaching experience is a significant predictor of subject matter knowledge of biology teachers.

Hypothesis Two

Teaching experience is not a significant predictor of biology teachers' knowledge of instructional strategies n secondary schools in Enugu Education Zone.

Table 5: Test of significance of simple regression analysis with teaching experience as predictor of biology teachers' knowledge instructional strategies

	B	SE B	*β*	t	*p*-value
Constant	5.125	1.380		3.714	.000
Knowledge of instructional strategies	-.59	.051	-.129	-1.156	.251
R .129					
R^2 .017					
Adj.R^2 .004					
F 1.336					.251

Data in table 5, shows that the simple regression coefficient (R) =.129 while the coefficient of determination (R2) is .017. The F-ration associated with these is 1.336 and the P-value=.251, since P-value is greater than the stipulated 0.05 level of significance, it was decided that teaching experience is not a significant predictor of biology teachers' knowledge of instructional strategies.

Hypothesis Three

Teaching experience is not a significant predictor of biology teachers' biology curriculum Knowledge in secondary schools in Enugu Education Zone.

Table 6: Test of significance of simple regression analysis with teaching experience as predictor of biology teachers' biology curriculum knowledge

	B	β	t	*p*-value
Constant	4.232		3.559	.001
Knowledge of biology curriculum	-.052	-.062	-.552	.582
R .062				
R^2 .004				
Adj.R^2 .009				
F .305				.582

As shown by summary of simple regression analysis in table 6, the regression coefficient (R) =.0.62, R^2= .062, R^2=.004 while F-ratio =.305 and the P-value =.582. Since the P-value is greater than the stipulated 0.05 level f significance, it was decided that teaching experience is not a significant predictor of biology teachers' biology curriculum knowledge.

Discussion of Findings

The findings of this study revealed that teaching experience contributed significantly in the prediction of biology teachers' subject matter knowledge. This is in line with the findings of Cochran, DeRuiter and King in Ezenwabachili (2016) who found out that novice teachers often are not grounded in their knowledge of the subject matter and this makes them to rely completely on textbooks in their lessons. Elif and Sibel (2007) also had a similar finding that inexperienced teachers have incomplete and superficial levels of pedagogical content knowledge. These findings also agree with Rice (2010) who observed that experienced teachers are effective than less experienced counterparts. However, this study's finding did not conform to the findings of Olfos, Golrine and Estrella (2014) who did not record any difference in the subject knowledge of experienced and less experienced mathematics teachers. The findings of this study also revealed that teaching experience was not significant predictor of biology teacher's knowledge of instructional strategy. This finding is contrary to the recent findings reported by other scholars in the Nigeria setting such as Bello (2015) who found out that teachers' ability to use laboratory

equipment in the teaching of biology depended on their years of teaching experience. However, the findings of this study conforms with the findings reported by Sarpong and Apaak (2016) who reported no significant relationship between teaching experience of fitness instructors and their PCK. The non-significance contribution of teaching experience in explaining teachers' knowledge of instructional strategies may be linked to younger generation teachers' exposure to information on internet more than the older and more experience teachers. In the case of teachers' knowledge of biology curriculum, the findings of this study revealed that teaching experience did not make a significant contribution in explaining biology teachers' knowledge of biology curriculum as it contributed only 4% to the variance in biology teachers' knowledge of biology curriculum. This shows that over 96% of the variance in teachers' knowledge of biology curriculum cannot be explained by their experience. This finding does not completely support the findings of Mththwa-Kunene (2014) who noted that biology teachers developed their knowledge of nature of biology curriculum and the materials to be used in teaching biology through classroom experience. This therefore suggests that a teacher with more classroom experience in the teaching of his subject would have more knowledge of curriculum. This was not the case in the present study as other factor may have played more dominant role in teachers' curriculum knowledge. These factors may have moderated the predictive ability of teaching experience.

Conclusion

Based on the discussion of the findings, the following conclusion can be made:

1. Teaching experience contributed significantly in the prediction of biology teachers' subject matter knowledge.
2. Teaching experience was not significant predictor of biology teacher's knowledge of instructional strategy.
3. Teaching experience did not make a significant contribution in explaining biology teachers' knowledge of biology curriculum.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Teaching experience should not only be considered in the selection of teachers for the mentoring of novice biology teachers.
2. The promotion and recruitment of the teachers should not only be based on teaching experience rather other related factors like knowledge of subject matter, knowledge of instructional strategies and knowledge of his subject curriculum should be considered.
3. Government should constantly organize seminar and workshops for teachers on the use of modern teaching techniques and materials.

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